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Can Interleukin IL-1β Differentiate Immune Thrombocytopenia from Systemic Lupus Associated Thrombocytopenia?

Shaimaa F. Kamel[*1], Dalia Abdelrahman Meshref[2], Al-Shaimaa M. Abdel- Naiem[3], Fatma Mohamed Mohamed Kamel[1]

Departments of [1]Internal Medicine, [2]Clinical Pathology and [3]Rheumatology, Rehabilitation and Physical Medicine, Faculty of Medicine, Minia University, Minia, Egypt

[*]**Corresponding Author:** Shaimaa F. Kamel, **Mobile:** (+20) 01061331235, **Email:** shiamaa.fathi@mu.edu.eg

ABSTRACT

Background: Differentiating primary immune thrombocytopenia (ITP) from early stages of systemic lupus erythematosus (SLE)-associated thrombocytopenia (SLE-TP) is a challenge due to the lack of specific biomarkers.

Objective: This study aimed to evaluate the difference level of serum interleukin-1 beta (IL-1β) in patients with ITP, SLE-TP, SLE without thrombocytopenia (SLE-NTP), and healthy controls to assess its potential utility as a diagnostic biomarker.

Patients and methods: This case control study was conducted on 72 individuals aged 20-40 years. Patients were divided into four groups: ITP, SLE-TP and SLE-NTP, and healthy controls. Clinical, hematological, and immunological parameters were assessed. IL-1β levels were measured using ELISA.

Results: IL-1β showed markedly elevated levels in SLE-TP (26.7±7.8) compared to ITP (4.61 ± 1.6 pg/ml) and controls (18.7 ± 3.8 pg/ml) ($p<0.001$). IL-1β correlated positively with bleeding scores across all groups. IL-1β >10 showed 100% sensitivity and specificity in discriminating between ITP and SLE-TP (AUC=1.0, 95% CI: 1.0-1.0, $p<0.001$) .

Conclusions: IL-1β demonstrated exceptional potential as a diagnostic biomarker for differentiating ITP from SLE-TP, offering perfect discrimination at a threshold of >10 pg/ml. This finding could significantly improve diagnostic accuracy and treatment decision-making in clinical practice.

Keywords: Interleukin-1β, ITP, SLE, Thrombocytopenia, Biomarker.

INTRODUCTION

ITP is an acquired autoimmune hemorrhagic disorder characterized by platelet count below 100×10^9/L without other evident causes of thrombocytopenia, displaying diverse clinical features, treatment responses, and pathogenesis mechanisms, including autoantibody production, T-cell dysfunction, and megakaryocyte abnormalities [1].

SLE is a complicated autoimmune illness that usually has hematological symptoms [2]. Thrombocytopenia (TP) occurs in 7-30% of SLE patients [3], and conversely, SLE represents the most common cause of secondary TP, accounting for approximately 5% of adult TP cases [4]. SLE-associated TP (SLE-TP), defined as platelet counts below 100×10^9/L without other identifiable causes [5], shares pathogenic similarities with primary ITP, particularly regarding autoantibody-mediated platelet clearance. This apparent overlap between the presentation of ITP and SLE, especially in early stages of lupus when the only presentation is thrombocytopenia, needs to be differentiated as early as possible before evolving into lupus years later. Early discrimination between those disorders giving the physicians great opportunity to select the proper treatment and improving patients life. However, the absence of specific biomarkers to differentiate between those conditions presents a significant diagnostic challenge [6, 7].

The IL-1 family, which includes 11 distinct protein molecules [8], plays a pivotal role as a mediator in a range of conditions, including autoinflammatory disorders, infections, cancers, and autoimmune diseases, primarily through its interaction with the Toll-like/IL-1 receptor superfamily [9, 10]. Targeting IL-1, especially IL-1β, has become a widely accepted treatment strategy for autoinflammatory diseases [11, 12], and holds therapeutic potential in oncology by inhibiting the IL-1 receptor [13, 14]. Emerging research has linked dysregulated levels of IL-18 and IL-18-binding protein (IL-18BP) to the development of SLE and ITP [15, 16]. Additionally, IL-1's influence on the differentiation of T-helper 17 (Th17) cells [17, 18], along with the observed elevation of Th17 cells in SLE and ITP patients, indicates that IL-1 family cytokines may contribute to the underlying mechanisms of these diseases.

Given that ITP diagnosis currently relies on excluding other conditions in the absence of definitive biomarkers, it is important to recognize that secondary TP can manifest in the context of various underlying diseases, particularly SLE. Therefore, this study seeks to evaluate the serum level of IL-1B cytokine in four separate groups: Individuals with primary ITP, those with SLE and concurrent thrombocytopenia (SLE-TP), and SLE patients without thrombocytopenia (SLE-NTP) and the last one is apparently healthy control individuals. This comparative analysis aimed to elucidate the potential diagnostic utility and pathogenic implications of this cytokine within these distinct clinical contexts.

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PATIENTS AND METHODS

This case-control study encompassed 72 participants aged 20-40 years, diagnosed with either ITP or SLE according to established clinical and laboratory parameters, along with age- and sex-matched healthy controls recruited through the period from October 2023 to December 2024 at Hematology Unit in collaboration with Rheumatology Department, Minia University Hospital. The study populations were subsequently categorized into four groups: ITP, SLE-TP, SLE-NTP and control.

Exclusion criteria: Presence of overlapping autoimmune disorders or other causes of thrombocytopenia.

Demographic and clinical parameters, including age, sex, presence of comorbidities (hypertension [HTN], family history of thrombocytopenia, and disease duration were systematically documented and recorded.

Clinical measurements were obtained utilizing standardized protocols, wherein blood pressure, heart rate and bleeding assessment scores [19] were systematically evaluated.

Laboratory investigations: Each subject had about 9 ml of venous blood drawn by sterile venipuncture. This sample was divided up as follows: 2 ml were obtained and deposited in a sterile vacutainer tube containing EDTA solutions for CBC test, 1.6 ml were added to a sterile tube containing 0.4 ml of 3.8% trisodium citrate (TSC) solution for ESR determination, 5 mL of venous blood were deposited in separator gel serum tubes and incubated for 30 minutes at 37 °C before being centrifuged for 15 minutes at 3,500 rpm. Then serum was utilized to test renal and hepatic functions, complement components (C3, C4), antinuclear antibodies (ANA), and anti-double-stranded DNA (Anti-dsDNA). The residual serum was kept at -20 °C for assay of **Interleukin-1 Beta (IL-1β).**

CBC parameters were analyzed via automated hematology analyzers (Celltac G, Nihon Kohden Corporation Automated Hematology Analyser, Japan). Differential leucocytic count was confirmed by microscopic examination of lieshman stained blood film. The parameters that were quantified included hemoglobin (Hb) concentration, total leukocyte count (TLC), lymphocyte percentage, and platelet count. Renal function, liver function, C3 and C4 levels were measured using an Automated chemical analyser (Mindray BS-800, China). ESR was calculated using the Westergren method. ANA and Anti-dsDNA were detected and quantified through ELISA methodology using QUANTA Lite kits (INOVA Diagnostics,CA, USA) . IL-1β quantification was performed utilizing ELISA kits (Cat. No. E0143Hu; Bioassay technology laboratory, China).

Ethical approval: Minia University Institutional Review Board gave ethical approval for the study (IRB-No.: 963/10/2023). Before enrolling, all subjects provided informed permissions. The Helsinki Declaration was followed throughout the course of the study.

Statistical analysis

The statistical analysis was conducted with SPSS version 26.0. For multiple comparisons between the three groups, Tukey's Post-Hoc test was used, and quantitative data were presented as mean ± SD and examined using a one-way ANOVA (F-test). Frequencies and percentages (%) were used to indicate qualitative variables, and the X^2-test was used for analysis. Median and IQR were used to express non-normally distributed data, which are then compared using the Kruskal-Wallis and Mann Whitney tests. Spearman's rank correlation coefficient was used for non-normally distributed data or non-linear monotonic correlations, whereas Pearson's correlation coefficient was used for regularly distributed data with linear associations to analyse relationships between variables. By using ROC curve analysis, the diagnostic accuracy of each test was ascertained. It was deemed statistically significant when the two-tailed p-value was ≤ 0.05.

RESULTS

Table (1) showed that, no statistically substantial differences were observed in age and temperature across the four studied groups. However, sex distribution, prevalence of HTN, and family history of SLE exhibited significant variation among the studied groups. Notably, SBP and DBP were significantly elevated in the SLE-TP group compared to the other three groups. Heart rate was significantly higher in the ITP, SLE-TP, and SLE-NTP groups relative to the control group, and further elevated in the SLE-TP group compared to the SLE-NTP group.

The bleeding assessment score was notably higher in both the ITP and SLE-TP groups than the control and SLE-NTP groups, with a notably lower score observed in the SLE-TP group relative to the ITP group.

Table (1): Baseline data among studied cases

		ITP (n=18)	SLE-TP (n=18)	SLE-NTP (n=18)	Control (n=18)	P value
Age (years)[1]		27.3±5.1	26.6±3.5	26.2±7.1	31.6±8	0.051
Sex[3]	**Female**	10 (55.6%)	18 (100%)	15 (83.3%)	17 (94.4%)	**0.002***
	Male	8 (44.4%)	0 (0%)	3 (16.7%)	1 (5.6%)	
HTN[3]		4 (22.2%)	15 (83.3%)	5 (27.8%)	0 (0%)	**<0.001***
Family history[3]		8 (44.4%)	0 (0%)	0 (0%)	0 (0%)	**<0.001***
Duration of disease[2] (years)		2.5 (1.75-4)	2 (2-5)	3 (2-4.25)	-	-
Systolic blood pressure[1] (mm Hg)		110.5±12	145±15.4	118.3±17.9	113.3±6.8	**<0.001***
P1<0.001*, P2=0.33, P3=0.92, P4<0.001*, P5<0.001*, p6=0.69						
Diastolic blood pressure [1] (mmHg)		68.8±9	90±10.2	73.3±12.2	73.3±9.7	<0.001*
P1<0.001*, P2=0.57, P3=0.57, P4<0.001*, P5<0.001*, p6=0.99						
Temperature[1] (℃)		37±0.33	37.2±0.42	37±0.64	36.9±0.25	0.23
Heart rate[1] (beats/min)		87.6±6	92.5±3.9	85.8±7.3	80.1±7.4	<0.001*
P1=0.11, P2=0.84, P3=0.005*, P4=0.01*, P5<0.001*, p6=0.04*						
Bleeding assessment score[1]		3.27±0.5	1.94±0.93	0	0	<0.001*
P1<0.001*, P2<0.001*, P3<0.001*, P4<0.001*, P5<0.001*, p6=1						

1= results are expressed as mean ± SD and compared by ANOVA test followed by post hoc test. 2= results are expressed as Median (IQR) and compared by Kruskal Wallis followed by Mann Whitney test.3= results are expressed as frequency & percentage compared by Chi square test. DM: diabetes mellitus, HTN: hypertension. * Significant at p value <0.05, **P1** is p value between ITP and SLE-TP, **P2** is p value between ITP and SLE-non-TP, **P3** is p value between ITP and control, **P4** is p value between SLE-TP and SLE-non TP, **P5** is p value between SLE-TP and control, **P6** is p value between SLE-non-TP and control.

In table (2), no notable variations were observed in TLC, ALT and AST levels across the four studied groups. Hemoglobin levels were markedly reduced in the ITP group compared to the control group but were elevated relative to the SLE-TP group, while showing no substantial difference with the SLE-NTP group. Lymphocyte counts, serum albumin, and total protein levels were considerably lower in both SLE-TP and SLE-NTP groups compared to the ITP and control groups. Platelet counts were notably diminished in the ITP group compared to the other groups, as well as in the SLE-TP group relative to the SLE-NTP and control groups. Creatinine and urea levels were notably elevated in the SLE-TP and SLE-NTP groups compared to the ITP and control groups.

Table (2): Laboratory data of the studied groups

	ITP (n=18)	SLE-TP (n=18)	SLE-NTP (n=18)	Control (n=18)	P value
Hemoglobin[1] (g/dl)	10.1±1.2	8.4±1.37	10.6±1.10	13.2±0.75	<0.001*
P1<0.001*, P2=0.66, P3<0.001*, P4<0.001*, P5<0.001*, p6<0.001*					
TLC[1] (x10^9/L)	8.6±2	6.3±1.1	7.17±1.7	6.8±1.2	0.07
Lymphocyte[1] %	29.4±4.4	21.3±5.5	17±4.8	29.4±4.4	<0.001*
P1=0.003*, P2<0.001*, P3=0.99, P4=0.22, P5=0.003*, p6<0.001*					
Platelet[1] (x10^9/L)	36.7±9.9	86.6±3.2	251.7±8.4	240.2±6.5	<0.001*
P1=0.03*, P2<0.001*, P3<0.001*, P4<0.001*, P5<0.001*, p6=0.92					
Creatinine[1] (mg/dl)	0.77±0.1	2.25±0.4	2±0.1	0.81±0.18	<0.001*
P1=0.005*, P2=0.02*, P3=0.99, P4=0.94, P5=0.006*, p6=0.03*					
Urea [1] (mg/dl)	28.2±5.1	68±3.3	79.8±6.1	29.8±5.5	<0.001*
P1=0.006*, P2<0.001*, P3=0.99, P4=0.73, P5=0.008, p6<0.001*					
ALT[1] (IU)	16.5±2.5	18.5±1.1	20.3±1.5	17.8±3.5	0.60
AST[1] (IU)	18.8±3.9	15.3±3.1	27.1±3	19±4.9	0.22
Serum albumin[1] (g/dl)	4±0.30	2.8±0.63	2.4±0.39	4±0.30	<0.001*
P1<0.001*, P2<0.001*, P3=0.99, P4=0.03*, P5<0.001*, p6<0.001*					
Total protein[1] (g/dl)	7.3±0.49	4.7±0.88	4.4±0.8	7.3±0.49	<0.001*
P1<0.001*, P2<0.001*, P3=0.99, P4=0.79, P5<0.001*, p6<0.001*					
INR[1]	1	1	1.01±0.04	0.99±0.02	0.29

1= results are expressed as mean ± SD and compared by ANOVA test followed by post hoc test. TLC: Total Leukocyte Count, ALT: Alanine Transaminase, AST: Aspartate Transaminase, INR: International Normalized Ratio, * Significant at p value <0.05, **P1** is p value between ITP and SLE-TP, **P2** is p value between ITP and SLE-non-TP, **P3** is p value between ITP and control, **P4** is p value between SLE-TP and SLE-non TP, **P5** is p value between SLE-TP and control, **P6** is p value between SLE-non-TP and control.

In table (3), complement levels showed distinct patterns, with C3 values significantly differing among groups (p=0.03), particularly between SLE-TP and control groups (p=0.05). C4 levels demonstrated notable variation (p=0.006), with the most pronounced difference observed between SLE-TP and control groups (p=0.007). Activity markers exhibited marked elevation in SLE groups, with ESR showing highly significant differences (p<0.001) between ITP and both SLE groups (p<0.001). ANA and Anti-DS positivity was exclusively observed in SLE groups (100% and 66.7% respectively, p<0.001). Most notably, IL-1β levels showed striking variation among groups (p<0.001), with significantly elevated levels in SLE-TP (26.7±7.8) compared to ITP (4.61±1.6) and control groups (18.7±3.8).

Table (3): Markers of activity between studied groups

	ITP (n=18)	SLE-TP (n=18)	SLE-NTP (n=18)	Control (n=18)	P value
C3[1] (mg/dl)	76.5±9.4	68±11.5	100.7±7.7	97.5±4.9	0.03*
	P1=0.91, P2=0.26, P3=0.38, P4=0.05*, P5=0.12, p6=0.99				
C4[1] (mg/dl)	15±1.2	11.8±2	19.9±3.9	22.7±4.5	0.006*
	P1=0.76, P2=0.42, P3=0.09, P4=0.06, P5=0.007*, p6=0.42				
ESR[1] (mm/hr)	20.7±13.3	111±7	102.2±20.9	13.1±2.6	<0.001*
	P1<0.001*, P2<0.001*, P3=0.29, **P**4=0.13, **P**5<0.001*, **p**6<0.001*				
Positive ANA[2]	0	18 (100%)	18 (100%)	0	<0.001*
Positive Anti-DS[2]	0	12 (66.7%)	12 (66.7%)	0	<0.001*
IL-1β[1] (pg/mL)	4.61±1.6	26.7±5.8	22±4.2	18.7±3.8	<0.001*
	P1<0.001*, P2<0.001*, P3<0.001*, P4=0.05*, P5<0.001*, **p**6=0.27				

1= results are expressed as mean ± SD and compared by ANOVA test followed by post hoc test. 2= results are expressed as frequency & percentage compared by Chi square test or Fisher Exact test. C3: Complement 3, C4: Complement 4, ESR: Erythrocyte Sedimentation Rate, Positive ANA: Positive Antinuclear Antibody, Positive Anti-DS: Positive Anti-double stranded DNA, IL-1β: Interleukin-1 beta. * Significant at p value <0.05, **P1** is p value between ITP and SLE-TP, **P2** is p value between ITP and SLE-non-TP, **P3** is p value between ITP and control, **P4** is p value between ITP and SLE-TP, **P4** is p value between SLE-TP and SLE-non TP, **P5** is p value between SLE-TP and control, **P6** is p value between SLE-non-TP and control.

In table (4), ITP cases, there was a notable inverse association was observed with albumin levels (r = -0.49, p = 0.03). When examining all cases collectively (n = 72), several strong associations emerged: positive connections with SBP (r = 0.37, p = 0.001), DBP (r = 0.32, p = 0.005), and bleeding score (r = 0.42, p < 0.001). Furthermore, robust relationships were identified with immunological markers, such as ESR (r = 0.59, p < 0.001),ANA (r = 0.64, p < 0.001), and Anti-DS (r = 0.47, p < 0.001).

Table (4): Correlation between IL-1β and other variables in different groups

	ITP cases (n=18)		SLE-TP (n=18)		SLE (n=18)		All cases (n=72)	
	r	**P value**	**R**	**P value**	**R**	**P value**	**r**	**P value**
Age	-0.05	0.83	-0.35	0.14	-0.18	0.46	-0.11	0.35
SBP	0.07	0.77	-0.10	0.68	-0.37	0.12	0.37	**0.001***
DBP	-0.03	0.90	-0.20	0.41	-5446jtwd3e0.29	0.24	0.32	**0.005***
Heart rate	-0.11	0.63	0.37	0.13	0.24	0.33	0.15	0.19
Bleeding score	-0.004	0.98	0.29	0.23	-	-	0.42	**<0.00 ***
Hb	-0.02	0.92	0.31	0.20	-0.06	0.78	-0.11	0.33
TLC	0.08	0.74	-0.04	0.86	0.004	0.98	0.24	**0.03***
Lymphocyte	0.009	0.97	0.40	0.09	0.006	0.98	-0.30	**0.01***
Platelet	0.18	0.43	-0.32	0.18	-0.21	0.40	0.31	**0.008***
Creatinine	0.008	0.97	0.30	0.21	-0.06	0.80	0.37	**0.001***
Urea	0.09	0.71	0.22	0.37	0.02	0.92	0.38	**0.001***
ALT	-0.01	0.95	0.40	0.09	-0.42	0.08	0.11	0.32
AST	0.04	0.86	0.33	0.17	-0.21	0.39	-0.04	0.73
Albumin	-0.49	**0.03***	0.25	0.30	0.13	0.60	-0.47	**<0.001***
Total protein	-0.002	0.99	0.32	0.19	0.13	0.58	-0.52	**<0.001 ***
INR	-	-	-	-	0.43	0.06	0.12	0.28
C3	-0.09	0.71	0.07	0.75	-0.23	0.34	-0.04	0.92
C4	-0.19	0.43	0.73	0.12	-0.19	0.43	-0.01	0.89
ESR	0.19	0.43	-0.39	0.10	-0.10	0.69	0.59	**<0.00 ***
ANA	-	-	-	-	-	-	0.64	**<0.001 ***
Anti DS	-	-	-0.12	0.61	0.29	0.24	0.47	**<0.001 ***

TLC: Total Leukocyte Count, **ALT:** Alanine Transaminase, **AST:** Aspartate Transaminase, **INR:** International Normalized Ratio, **C3:** Complement 3, **C4:** Complement 4, **ESR:** Erythrocyte Sedimentation Rate, **Positive ANA:** Positive Antinuclear Antibody, **Positive Anti-DS:** Positive Anti-Desmoglein), **IL-1b:** Interleukin-1 beta. r: correlation, * Significant at p value <0.05.

In table (5) and figures (1), (2), (3) & (4) the ROC curve analysis revealed that serum level of IL-1β is a perfect discriminator of thrombocytopenia in ITP patients from those with SLE, with an AUC of 1.0 (95% CI: 1.0-1.0, p<0.001). At cut-off value of > 10, both sensitivity and specificity reached 100%, yielding perfect positive and negative predictive values (100% each). The total diagnostic accuracy was correspondingly 100%.

Table (5): ROC curve analysis for IL-b for discriminating between ITP and SLE with thrombocytopenia, also for diagnosis of ITP and for diagnosis of SLE with thrombocytopenia

	IL-b for discriminating between ITP and SLE with thrombocytopenia	IL-b for diagnosis of ITP compared with control	IL-b for diagnosis of SLE with thrombocytopenia compared with control	IL-b for discriminating between SLE with thrombocytopenia and without
AUC	1	1	0.80	0.68
95% CI	1-1	1-1	0.65-0.96	0.50-0.85
P value	<0.001*	<0.001*	0.002*	0.06
Cut of value	>10	<10	>19.5	>24.5
Sensitivity	100%	100%	83.3%	66.7%
Specificity	100%	100%	66.7%	61.1%
PPV	100%	100%	71.4%%	63.2%
NPV	100%	100%	80%	64.7%
Total accuracy	100%	100%	75%	63.8%

AUC: area under the curve, CI: confidence interval, PPV: positive predictive value, NPV: negative predictive value.

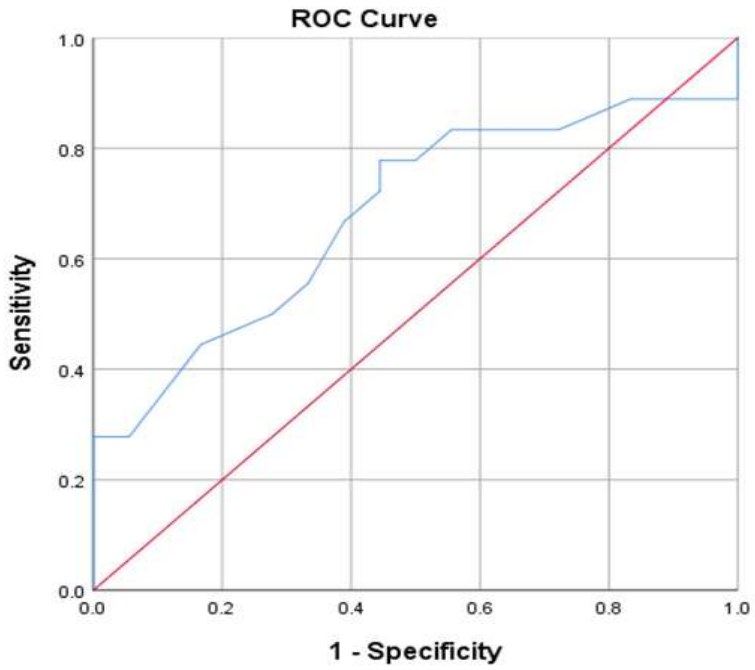

Figure (1): ROC curve analysis for IL-b for discriminating SLE with thrombocytopenia and without.

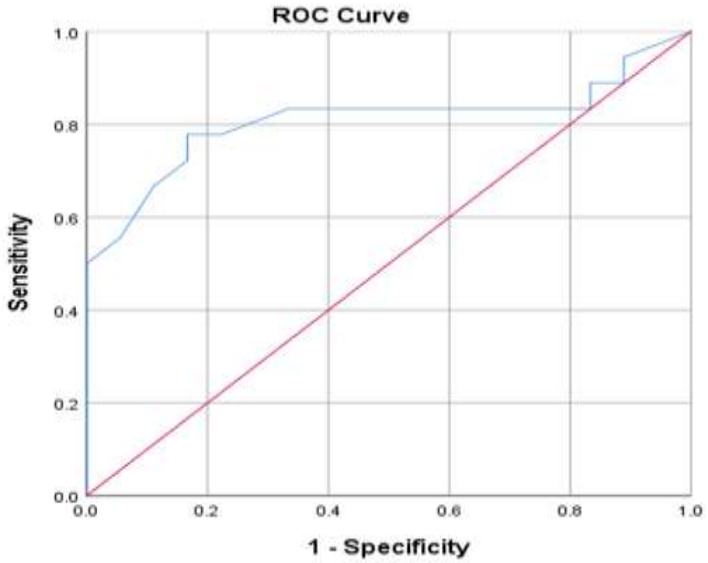

Figure (2): ROC curve analysis for IL-b for diagnosis of SLE with thrombocytopenia compared to control.

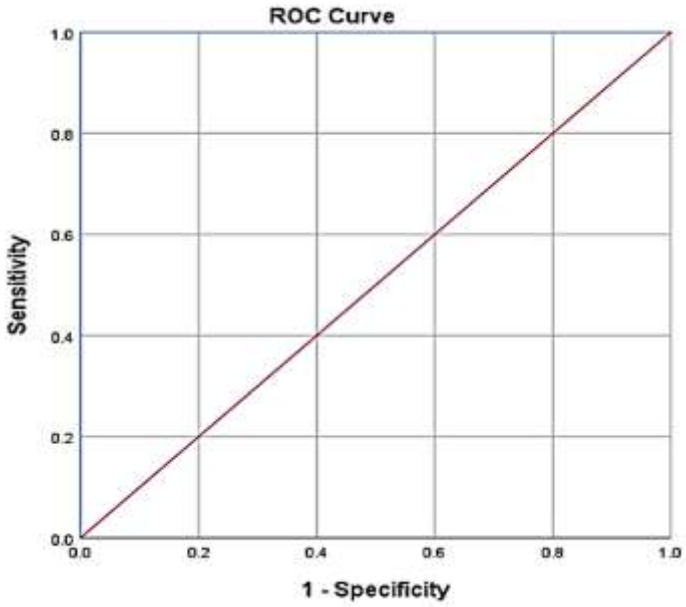

Figure (3): ROC curve analysis for IL-b for diagnosis of ITP compared to control

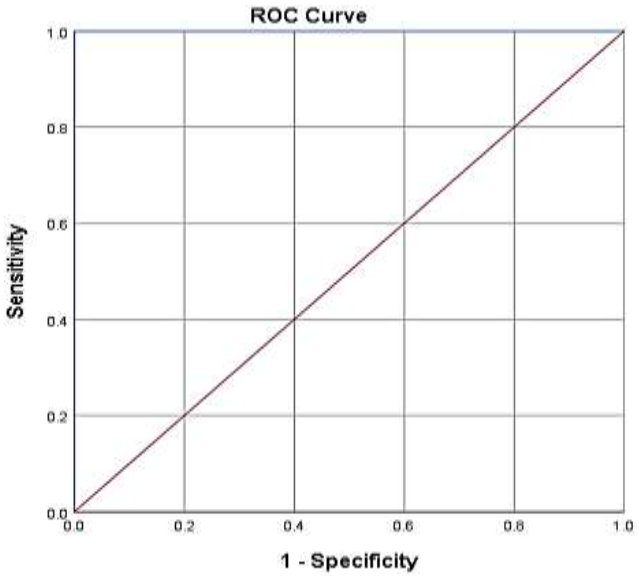

Figure (4): ROC curve analysis for IL-1b for discriminating between ITP and SLE associated thrombocytopenia.

DISCUSSION

This study aimed to explore the role of IL-1 in differentiating is thrombocytopenia due to ITP or SLE, highlighting the diagnostic utility of IL-1β.

Our study demonstrated notable demographic and clinical distinctions between ITP and SLE-TP groups. The observed gender distribution pattern, with SLE-TP showing female predominance (100%) and ITP displaying a more balanced distribution (55.6% females, 44.4% males), which lookalikes the traditional epidemiological patterns reported in the literature. This finding matches with the observations of **Mende *et al.*** [20], who reported a female predominance (91%) in their SLE cohort of 184 patients.

The bleeding assessment scores showed significant variation between ITP (3.27±0.5) and SLE-TP (1.94±0.93) patients. This outcome matches with **Zhan *et al.*** [21] who informed higher bleeding scores in ITP patients. This differential presentation could serve as a valuable clinical indicator for initial disease differentiation.

The hematological profile revealed distinct patterns between ITP and SLE-TP patients. The severe thrombocytopenia observed in ITP patients (36.7±19.9 × 10^3/μL) matches with **Zhan *et al.*** [21] who reported a median platelet count of 9×10^9/L in ITP patients compared to 66×10^9/L in SLE-TP patients. The more severe thrombocytopenia in ITP patients, despite lower bleeding scores in SLE-TP, suggests different pathophysiological mechanisms underlying platelet reduction in these conditions.

The marked anemia in SLE-TP patients (hemoglobin 8.4±1.37 g/dL) corresponds with findings of **Mende *et al.*** [20] who found an inverse correlation between hemoglobin levels and inflammatory markers in SLE patients. The significant elevation in renal function tests (creatinine 2.25±1.4 mg/dL in SLE-TP) further emphasizes the systemic nature of SLE and its impact on multiple organ systems.

The complement profile demonstrated significant variations among groups, with distinct patterns in C3 and C4 levels. This finding parallels the observations of **Mai *et al.*** [22], which showed an inverse connection between complement C3 levels and disease activity indicators in SLE patients. The exclusive presence of ANA and Anti-DS positivity in SLE groups (100% and 66.7% respectively) reinforces their diagnostic utility in distinguishing SLE-TP from ITP.

Our study's most striking finding concerns IL-1β levels, which showed remarkable variation between groups ($p<0.001$). The significantly elevated levels in SLE-TP (26.7±7.8) compared to ITP (4.61±1.6) contrasts with some previous findings. **Zhan *et al.*** [21] reported decreased IL-1β levels in ITP persons compared to SLE-TP, while **Italiani *et al.*** [23] revealed no notable variations in serum IL-1β levels were detected between SLE patients and healthy controls.

The perfect discrimination achieved by IL-1β at a cut-off value of >10 (AUC 1.0, 95% CI: 1.0-1.0) represents a potentially groundbreaking finding. However, this result should be interpreted in light of **Italiani *et al.*'s** [23] observations regarding the complex regulation of IL-1β activity through various receptors and soluble inhibitors in SLE patients.

The correlation analysis demonstrated notable relationships between IL-1β levels and multiple clinical and laboratory measures. The positive correlations with SBP ($r=0.37$, $p=0.001$), DBP ($r=0.32$, $p=0.005$), and bleeding score ($r=0.42$, $p<0.001$) across all cases provided additional clinical context for the utility of IL-1β as a biomarker. The strong correlations with immunological markers, including ESR ($r=0.59$, $p<0.001$), ANA ($r=0.64$, $p<0.001$), and Anti-DS ($r=0.47$, $p<0.001$), further provide additional evidence supporting its potential role in distinguishing between disease states.

Recent research has highlighted the complexity of IL-1 family in autoimmune conditions. **Wu *et al.*** [24] demonstrated elevated IL-37 levels in SLE persons, while **Mai *et al.*** [22] reported significant variations in IL-36 cytokine profiles. These findings, combined with our results, suggest a multifaceted interaction among IL-1 family cytokines in the underlying pathological mechanisms of both ITP and SLE-TP.

LIMITATIONS

The relatively small sample size and its single-center design, which may restrict the broader applicability of the findings, the case-control study design, and the lack of inclusion of additional biomarkers.

CONCLUSIONS

Our findings indicated that IL-1β holds potential as a valuable biomarker for early distinguishing between thrombocytopenia in both ITP and SLE-TP. The higher IL-1β levels observed in SLE-TP patients, contrasted with the reduced levels in ITP cases, imply that IL-1β may contribute differently to the underlying mechanisms of these two disorders.

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